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(54) Injection molding means

(57) The present invention is for a means for use in injection molding of thermoplastic material with use of a sprue bushing (1). The sprue bushing, which may include a front piece, improves the possibilities to reduce the heat dissipation from the thermoplastic material to the material in and adjacent to the tip of the bushing and the wear of the material of the bushing is reduced. According to the invention there is an insert bushing (4, 9, 15) of ceramic material present at the tip of the sprue bushing/front piece.

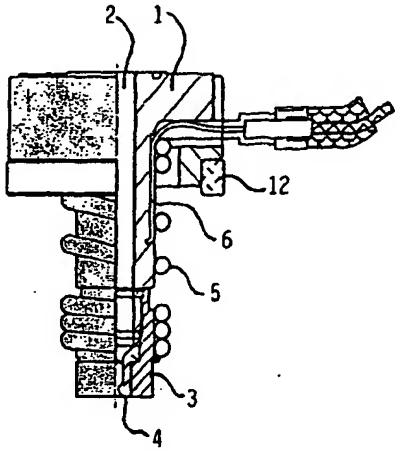

Fig 1

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De cription

[0001] The present invention is for a means for use at injection molding of thermoplastic materials with hot-runner in an equipment with sprue bushing.

[0002] This method is often used for tools which have several cavities for simultaneous molding of several pieces of goods. These are usually identical but may also be of different appearance. It is desirous both to reduce the loss of material as much as possible and to attain the shortest possible cycle times. Molds of this kind may be designed with a common inlet channel, a sprue, which branches into smaller runners, one for each cavity. In order to reduce the flow length in cold steel the sprue may be substituted for by a heated sprue bushing. Further improvements may be achieved by distributing the flow of material to two or more sprue bushings in a hot channel manifold. The best result is achieved if there is a n individual sprue bushing for each single mold cavity. The sprue bushing may also comprise a front piece and heating means and other details.

[0003] In order to keep the cycling times as short as possible and to avoid overheating of the plastic material it is desirous that the temperature of the material is maintained invariable and as low as possible. This is partly attained by the above described sprue bushings which are heated by electrical resistance elements on the outside of each bushing. The elements are so distributed over the surface that the possibly best temperature conditions are attained and control of the elements is by means of thermocouples or other temperature sensors. Further improvement is achieved by insulating the sprue bushings from surrounding metallic materials, where ceramic insulating material has proven to be suitable.

[0004] When injection molding using the above mentioned methods it is essential that the temperature of the material at the inlet to the mold cavity is high enough so that the material will low into and spread within the mold cavity, without being so high that the material will be damaged. At the same time it is desirous to keep the temperature low so that the material will solidify rapidly inside the mold so that the product may be discarded and another cycle of operation started.

[0005] The temperature a the tip of the ingot will then be crucial.

[0006] An object of the present invention is an means at sprue bushings which will further improve the possibilities to reduce the transfer of heat from the thermoplastic material to the material in and at the tip of the bushing. It is a further object to reduce the wear of the material of the bushing. This is achieved with a means and a sprue bushing which has the characteristics that are apparent from claim 1.

[0007] The invention will below be described more in detail with reference to the embodiments that are shown in the enclosed drawings.

[0008] Figure 1 shows in partial cross-section a sprue bushing according to the invention.

[0009] Figure 2 shows a part of the bushing of figure 1.

[0010] Figure 3 shows the outer, front part of the sprue bushing.

[0011] Figure 4 shows an insert for the front part.

[0012] Figure 5 shows another embodiment of the front part of the sprue bushing.

[0013] Figure 6 shows the outer, front part of the bushing of figure 5.

[0014] Figure 7 shows an insert to the bushing of figure 6.

[0015] Figure 8 shows a further embodiment of the invention.

[0016] All figures are in full or partial cross-section.

[0017] The sprue bushing comprises a body 1 which preferably is made from steel. The body 1 is mounted into the mold and is thermally insulated from it by an insulating ring 12, preferably made from ceramic material. The bushing extends itself downwards in the direction of the figure inwards into the mold and terminates with a front piece 3, 7 which is fixed to the bushing body 1. The sprue bushing is heated by an electrical element 5 which is wound around the body of the bushing and the front piece, where the pitch of the winding is varied in order to achieve the possibly best heat distribution. The temperature is monitored and controlled by means of a thermocouple 6. The front piece has at the bottom surface which faces the mold an outlet opening or inlet 13, 14 through which the thermoplastic material is pressed into the mold cavity.

[0018] In order to further reduce the dissipation of heat to surrounding goods, increase the precision of the temperature of the material and increase the wear resistance of the sprue bushing it has, closest to the tip of the front piece at the outlet opening 13 in the embodiment of figures 5-7, an insert bushing 9 made from ceramic material. The sprue bushing and the front piece are in this case closest to mold delimited by a bottom 8 made from steel of the smallest possible goods thickness. The bottom 8 may be advantageous when heat is dissipated through it and the cooling of the material in the outlet opening is speeded up so that the time of the operating cycle may be reduced.

[0019] In another embodiment of the invention in accordance with figures 2-4 the insert bushing 9 is also a bottom surface of the sprue bushing and the front piece so that the heat transfer in this region is further reduced as compared to the above described embodiment. In both cases the advantages which come from the ability of the ceramic material to withstand wear better than steel are attained inside the flow paths.

[0020] The ceramic bushings are mounted into the front pieces 3, 7 and the outlet openings may be designed in various ways as is shown in the figures. During shot injection the machine die contacts the top side of the sprue bushing in connection to the flow channel 2.

[0021] In the embodiment of the invention which is shown in figure 8 a ceramic bushing 15 is positioned in the mold 16. The front piece 3 has a lower part 17 which

extends itself downwards to an opening 18 in the ceramic bushing and the mold into the mold cavity. The front piece 3 has a small direct contact surface at the mold 16 in order to obtain support of the bushing as required. In variations of this embodiment the ceramic bushing 15 may be extended upwards so far that there is no direct contact between metallic material of the sprue bushing/the front piece and the mold. The material flows through the front part 17 of the bushing into the channel which is defined by the inside of the ceramic bushing 15 and the lower defining surface at the tip of the front piece.

[0022] Other embodiments of the invention are possible within the frame of the inventive idea, especially in respect of the outer shape and the shape of the internal channel of the ceramic insert bushings. Also the tip of the sprue bushing and the front piece may be designed in various ways in order to be adapted to the ceramic inserts.

Claims

1. Means for use for injection molding of thermoplastic material using a sprue bushing which may comprise a front piece characterized in that at the outlet opening of the sprue bushing/front piece and the corresponding inlet of a mold cavity there is a bushing (4, 9, 15) made from ceramic material inside which there is a flow channel for the thermoplastic material.

2. Means according to claim 1 characterized in that the ceramic bushing (4) is a part of the sprue bushing/front piece and comprises a contacting surface to contact with the wall of the mold cavity.

3. Means according to claim 1 or 2 characterized in that the sprue bushing/front piece is defined against the mold cavity by a bottom (8) of metallic material.

4. Means according to any of the preceding claims characterized in that the ceramic bushing (15) is mounted into the mold (16) with at least one contacting surface to the sprue bushing/front piece (3).

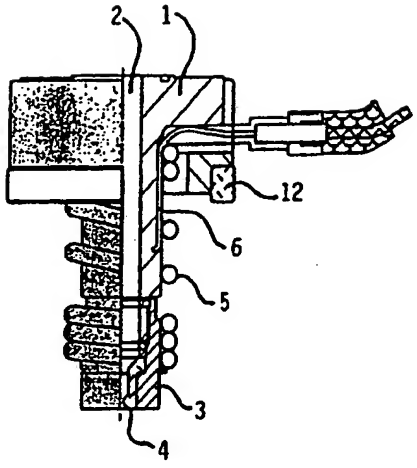


Fig 1

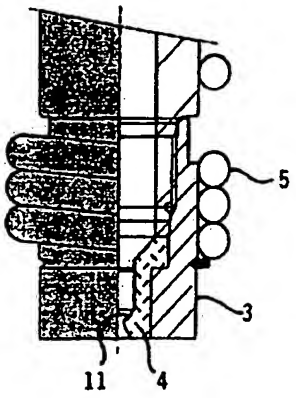


Fig 2

Fig 3

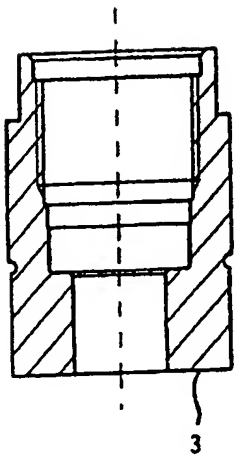


Fig 4

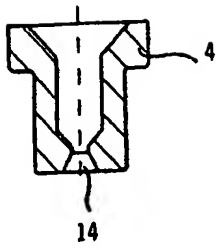


Fig 5

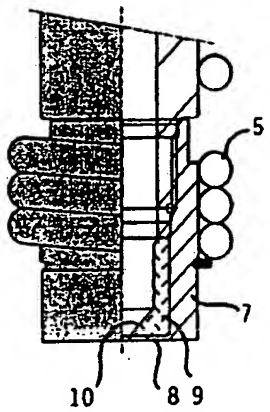


Fig 6

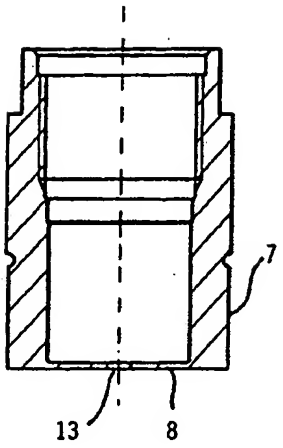
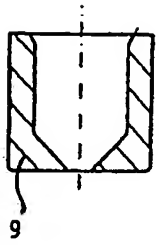


Fig 7



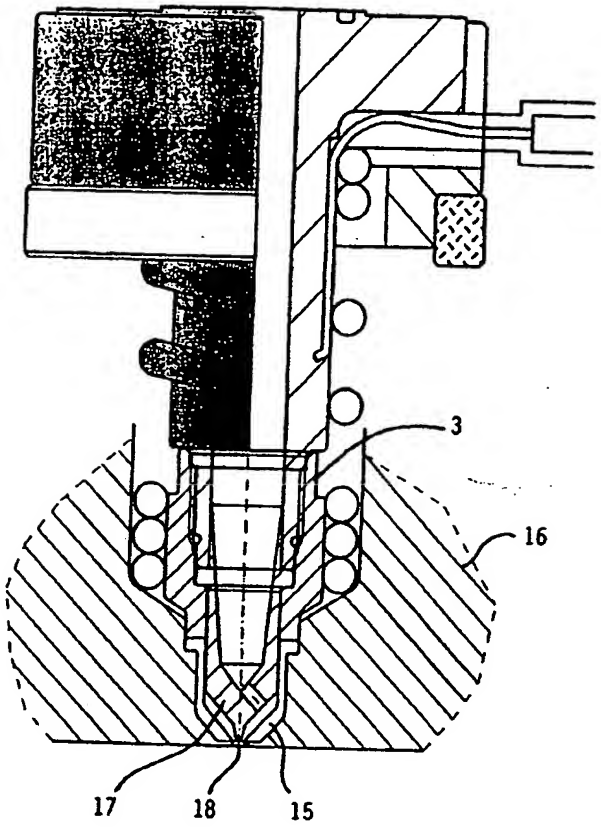


Fig 8

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EUROPEAN SEARCH REPORT

Application Number
EP 98 85 0181

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	EP 0 620 096 A (GELLERT JOBST U) 19 October 1994 * column 3, line 18 - line 20; claim 9; figures 2,3 *	1,4	B29C45/27
X	H. BOPP: "Heisskanalsysteme für technische Thermoplaste" PLASTVERARBEITER., vol. 28, no. 12, 1977, pages 649-654, XP002096658 SPEYER/RHEIN DE * paragraph 2.5.1; figure 7 *	1,2	
A	PATENT ABSTRACTS OF JAPAN vol. 12, no. 442 (M-766), 21 November 1988 & JP 63 176119 A (TOYOTA MOTOR CORP), 20 July 1988 * abstract *	1	
X	EP 0 453 894 A (BOSCH GMBH ROBERT) 30 October 1991 * claim 5; figure *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

B29C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	15 March 1999	Bollen, J

CATEGORY OF CITED DOCUMENTS

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15-03-1999

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